

Exam 1 – Spring 2014 – Solutions Notes

1. a. Testing undertaken to demonstrate that a system performs correctly is sometimes referred to as *validation testing*, while testing undertaken to expose defects is sometimes referred to as *defect testing*.

b. *Validation testing* is consistent with Boris Beizer's definition of testing (*tests are designed and then executed to demonstrate the correspondence between an element and its specification*) while *defect testing* is consistent with Glenford Myers' definition of testing (*...the process of executing a program with the intent of finding errors*).
2. a. regression testing: re-testing (i.e., re-running test cases that were run earlier without revealing errors) to detect problems (errors) caused by the adverse effects of program change

b. alpha testing: actual end-user testing performed within the development environment

c. soak testing: testing a system version over a significant period of time (even as newer versions become available) to discover latent errors or performance problems (due to memory leaks, buffer/file overflow, etc.)
3. MVQ builds on the premise that some companies test their web-based software services too much before releasing them to production since "**speed of release** is the vital competitive advantage in the world of connected services and devices."
4. c
5. a. minimum # of cases needed for *strong equivalence class testing*: **48**
minimum # of cases needed for *weak equivalence class testing*: **4**
b. minimum # of cases needed to cover the partitions: **2**
6. a. would
b. would
c. would not
d. would
e. would not
f. would
g. would not
7. a. deducible
b. not deducible
c. deducible
d. deducible
e. not deducible
f. deducible

8. a. The general approach taken was to **consider the mathematical definition of exponentiation as an implicit part of the specification for pow()**. The definition identifies various meanings of $x**y$ associated with different regions (points, lines, etc.) in the x,y plane. The specific source of info used for this was a standard **mathematical dictionary**.
- b. $\text{fmod}(x,y)$ returns the value $x - y*\text{FLOOR}(x/y)$ (and `errno` is not set) **when $x/y > 0$**
- $\text{fmod}(x,y)$ returns the value $x - y*\text{CEILING}(x/y)$ (and `errno` is not set) **when $x/y < 0$**
- c. 7
- d. 4
9. a. ALL (and ONLY the) du-pairs for variable A: (total 8 pts. when all correct and no incorrect du-pairs are listed)
- (1,2) (1,3) (1,<1,2>) (1,<1,3>) (2,2) (2,3) (2,<2,2>) (2,<2,3>)
- b. All (and ONLY the) du-paths associated with each of the following du-pairs for variable B: (total 7 pts. when all correct and no incorrect du-paths are listed)
- du-paths for (1,2): <1,2> <1,2,2>
- du-paths for (1,3): <1,3> <1,2,3> <1,2,2,3>
- du-paths for (1,<2,2>): <1,2,2>
- du-paths for (1,<2,3>): <1,2,3>
- c. $A > B$ & $A - B > B$ & $A - 2B > B$ & $A - 3B \leq B$ (total 4 pts.)
- d. $A=4, B=1$ (or any other X,Y values satisfying the correct path condition is OK) (total 1 pt.)
10. Edge <5,6> is covered by both set 1 and set 2. This represents the same false while loop "branch" as that represented by edge <1,6>. (Note that both edges have the same " $Y \leq 0$ " label".) The extra edge is just an artifact of the special graph that is used for dataflow coverage analysis to distinguish between taking the false branch of the while loop without executing the loop body at all, and taking the false branch after executing the loop body 1 or more times. This is relevant when considering du-paths coverage, but not when considering branch coverage.

11. Two forms of "fault-based testing" were discussed in class: Mutation Analysis and Error Seeding.

- a. Goal/Objective of Mutation Analysis: Mutation Analysis attempts to measure "test case set sufficiency" – i.e., how well a set of test cases can discriminate between the original, presumably correct program, and programs that are "close" (but not functionally identical) to it.

Goal/Objective of Error Seeding: The objective of Error Seeding is to estimate the "number of errors" remaining in a program.

- b. Potential drawback of Mutation Analysis discussed in class: The time and effort required to compile a large number of mutant programs and run the subject test set against each could be significant.

Potential drawback of Error Seeding discussed in class: (1) The measure "number of errors" is ambiguous. (2) Creating "errors" that are comparable to naturally occurring errors (e.g., being equally easy/hard to detect) is also problematic.

12. a. (1) the probability of no failure in a specified time interval, or (2) the expected mean time to failure

- b. Reliability is a measure that is relative to expected product usage. An operational profile provides a basis for approximating a distribution of expected usage for a particular environment so that reliability testing will result in a meaningful measure for that environment.

13. C, B, G, H, B, K, F, A

14. a. Migration here refers to errors introduced in a given development phase persisting (i.e., without having been detected and removed) in a subsequent development phase.

- b. An effective test program that can be applied early in the development process.

15. a. "vital testing principle": A necessary part of a test case is the definition of the expected output or result.

- b. "vital testing principle": Avoid throw-away test cases unless the program is truly a throw-away program.

16. g

17. a. is
b. is not
c. is not
d. is not
e. is
f. is

18. g

19. e

20. f

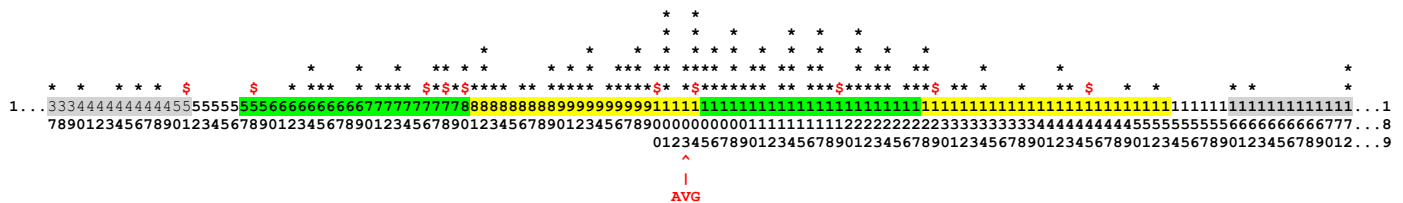
21. b

22. a. true
 b. true
 c. true
 d. false
 e. true

23. T, K, C, S, X, G, F, W, N, R

24. a. true
 b. false
 c. true
 d. true
 e. false

Histogram of Raw Scores



* - CEN 6070 students
 \$ - CEN 4072 students